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DISEASES OF THE NERVOUS SYSTEM

A PRACTICAL JOURNAL ON PSYCHIATRY AND NEUROLOGY

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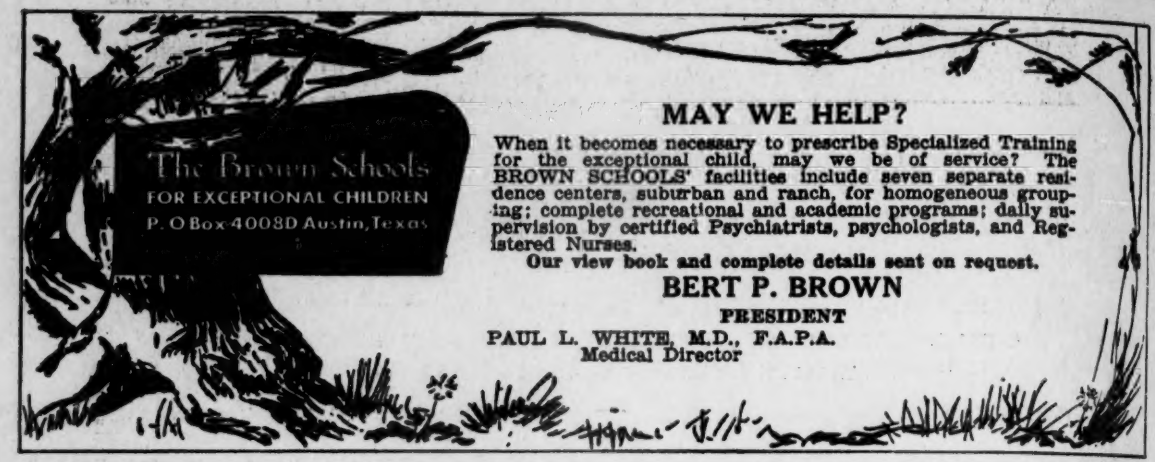

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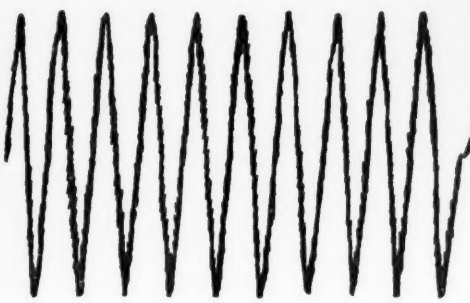

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DISEASES of the NERVOUS SYSTEM

A PRACTICAL JOURNAL ON PSYCHIATRY AND NEUROLOGY

Orbital Undercutting in the Treatment of Psychoneuroses, Depressions and Senile Emotional States

(Psychiatric and Physiologic Results of Fractional Lobotomy in the Milder Emotional Illnesses)

WILLIAM BEECHER SCOVILLE, M.D.
Hartford, Connecticut

Five years ago the writer presented a new method of fractional lobotomy permitting precise interruption of various cortical connections of the frontal lobe under direct vision by means of cortical undercutting.[1] The results,[2] chiefly in schizophrenic patients, were summarized in 1950 and have since been carried out in 230 patients with results roughly comparable to a standard lobotomy although interrupting only one-third the amount of surface area. Undercutting of the orbital or inferior surface of the frontal lobes has been carried out in 129 cases with a resulting absence of appreciable personality blunting or deficit when limited to this location. This has recently been confirmed by the studies of Rylander and Sjoqvist.[3] For this reason, selective cortical undercutting of the orbital surface of the frontal lobes has been performed in 47 cases of the milder emotional illnesses, and the results have been sufficiently gratifying to warrant this report.

Case Selection

Psychoneuroses and senile emotional states abound in every walk of life. In their more severe form, they are incapacitating to a severe degree, often causing a complete standstill in social and economic life. True endogenous depressions in younger age groups are less common and usually respond well to electroshock treatment in contradistinction to neurotic depressions and tension states which are made worse by shock therapy. Sargant of London[4] has stressed this difference, pointing out that endogenous depressions are at their worst upon awakening, and the neurotic depressions are worst at the end of the day. Orbital undercutting has been carried out in intractable cases in all of the above categories, including endogenous depressions occurring in persons too old for "shock" treatment, and in younger persons requiring more than one or two courses of electroshock therapy. This latter is advocated because of the writer's opinion that prolonged electroshock may cause more diffuse and permanent physiologic damage to total brain function than do limited orbital or inferior lobotomies. Proof is offered by noting the similarity of the prolonged memory changes and temporary confusional states following electroshock therapy to that found following head injuries.

Benefit by case selection has been in the following diminishing order: (a) senile emotional states with agitation, tension, insomnia, or depression; (b) true endogenous depressions and affective illnesses; (c) anxiety-tension states with vague fears; (d) obsessive-compulsive neuroses with morbid

Presented at the Society of Biological Psychiatry meeting, June 13, 1954.

From Department of Neurosurgery, Hartford Hospital, Hartford, Connecticut.

or repetitive thoughts and ritualistic acts; and (e) physical conversion states with fixation upon somatic symptoms of headaches, tinnitus, cardiac and G.I. symptoms, and ulcerative colitis.

Technique:

The technique of orbital undercutting of the inferior surface of the frontal lobes has been described.[1] In brief, 75% of psychoneurotic and depressed patients, including the aged, will permit the entire operation being done under local anesthesia. The remainder require small amounts of pentothal without intubation, with maintenance of an airway by strapping the chin by adhesive upwards to an overhead Mayo table. Skin incision follows the hairline, except in bald-headed persons where an incision is made through the midfrontal crease, and subperiosteal exposure is made of the frontal bone down to the orbital ridges. Bilateral 1½" supraorbital trephines are placed as far laterally as possible, slightly overlapping the temporal muscle attachments, with demonstration of the size of the frontal sinuses by preoperative skull films. The dura is opened by a "T" incision, extending downward to expose the inferior tips of the frontal poles; 3 cm. cortical incisions are made paralleling the roof of the orbit, placed 2 cm. above the roof, and by means of forceps with attached spatula blades and a No. 1 fine suction tip, the grey matter is undercut back to the level of the anterior clinoids and sphenoid ridge. Care is taken to remain at the approximate junction of white and grey matter, paralleling the roof of the orbit, checking the plane and extent of section frequently by lifting up the frontal poles and observing the location of the optic nerves and clinoids. At a usual distance of 5.5 to 6.5 cm. (Fig. 1), the plane of section emerges in the subpial space at the level of the anterior clinoids. As one moves laterally, the sphenoid ridge curves anteriorly, lessening the posterior distance to be undercut. Here also the undercutting emerges in the subpial cisternal space lying between the temporal and orbital lobes. Hence, the undercutting accomplishes an anatomical isolation of orbital cortex, leaving only pial and vascular attachments. Bilateral silver clip markers (Fig. 1, 2, 3) are now used to mark the posterior and anterior limits of the undercutting (beware inadvertent clipping of the anterior cerebral artery). It is important to carry the undercutting exactly parallel to the orbital roof, as there is a tendency to burrow too deep within the white matter. The dura is closed loosely; the bone buttons are replaced and covered with a square of tantalum mesh for cosmetic reasons; and

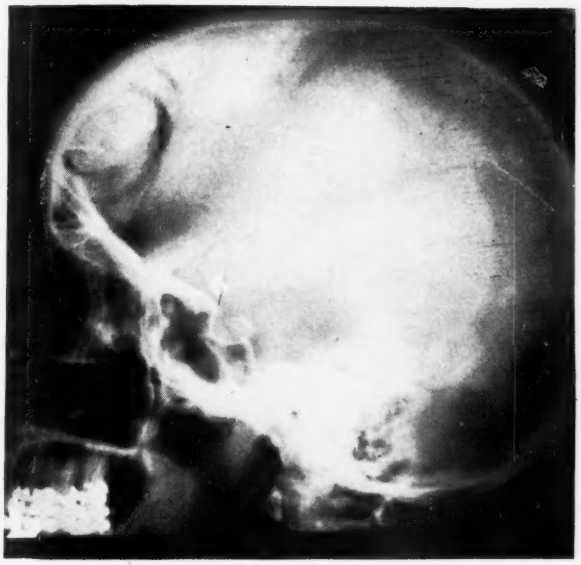

Fig. 2. Silver clips demonstrating a very complete standard orbital undercutting, extending approximately 6 cm. posteriorly from the frontal tips.

Fig. 1. Silver clips demonstrating the conservative undercutting, extending approximately 5.5 cm. posteriorly from the frontal tips.

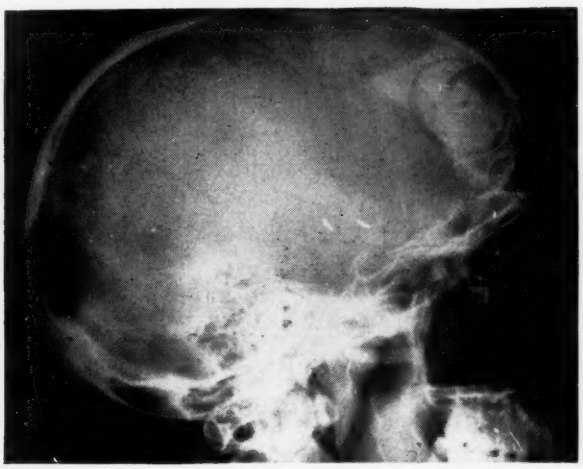

Fig. 3. Silver clips demonstrating radical posterior extension, extending 1-2 cm. posterior to the anterior clinoids and 7-7.5 cm. posterior to the frontal tips, in all probability involving the septal nuclei and subcalossal gyrus, and giving profound personality and physiologic effects.

the skin is closed with two layers of interrupted silk without drains. Patient is allowed up immediately, but with attendants for the first twenty-four hours.

In schizophrenic patients, a more radical posterior extension has been carried out to include undercutting of the extreme posterior limits of the orbital cortex, which has been found to extend as far back as some 1-2 cm. posterior to the anterior clinoids (Fig. 3), and, by measurements from the frontal pole, averages 6.5 to 7 cm. in extent. This radical posterior extension of the undercutting is not advocated in benign emotional disorders because of the resulting temporary grave personality changes and convulsions, as described under heading of "Complications." It may be advantageous in schizophrenic patients.

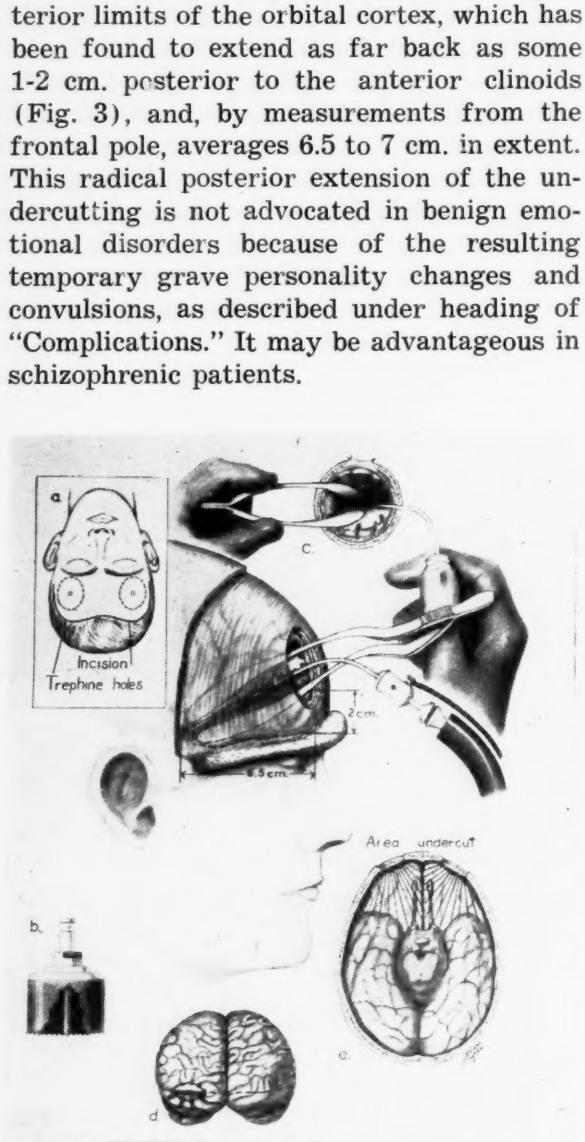

Fig. 4. Orbital Undercutting Technique.

Results

The results have been gratifying in all categories, causing a lessening of anxiety and tension, a fading of morbid obsessive thinking, a lightening of mood, and relief from drug and alcohol addiction provided they are secondary to anxiety or panic states. Fractional lobotomies do not benefit constitutional alcoholic, psychopathic or criminal types. When reviewing the older age group above the age of 65 years (17 in number), the results have been sufficiently gratifying to warrant a separate report.[5] In brief, it appears that the older the patient the more the benefit of any form of lobotomy sufficiently limited to prevent personality deficits. In those agitated, sleepless and involutional cases thought to be incapacitated by the destructive processes of old age, deliberate destruction of an additional portion of the frontal lobes has restored them to a happy and frequently useful existence. This is a cause for surprise and surmise as to the deeper dynamics of senility.

The results in the various categories indicate that depressions are the most easily benefited, regardless of the type of lobotomy or shock therapy used; anxiety and tension are next; mental symptoms of obsessions and compulsions are next; and somatic symptoms and physical conversion hysterias are the most intractable. Severe organic pain is not benefited by any form of limited lobotomy, especially orbital undercutting. There have been no adverse effects in the release of hostility or loss of social sensitivity except in those cases undergoing the radical posterior extension.

Mention is made of eight cases of pseudoneurotic schizophrenia, using the terminology of Hoch.[6] These patients exhibited an extreme neurotic overlay to a schizoid withdrawn personality. They were severely introverted and showed an absence of drive and ambition, and consciously or unconsciously, were masking their psychotic thought processes by apparent neurotic phobias and obsessions. Orbital undercutting made more manifest the underlying schizophrenia, inasmuch as postoperatively the patients openly expressed their delusions and fantasies. Eventual benefit over the ensuing year occurred to both the overlay and the psychosis. However, it is important, as Sargant points out,[4] that such cases be recognized and the relatives enlightened before subjecting them to operation.

As in standard lobotomies, the lift in mood, tension and anxiety is dramatic and sudden following the orbital undercutting, frequently beginning upon completion of one side, and being apparent to all by the end of

the operation. Such early improvement frequently fades after the first few days with reappearance after the first two weeks and slow continued improvement over months and perhaps years thereafter. In contradistinction to the improvement in mood, the obsessive-compulsive components show only slow and insidious improvement, the patient being the last to admit such improvement. The classical rigid personality of such neurotics is retained for life, but the compulsion to carry out their rituals and the anxiety attached to their obsessions fade.

Psychologic Results

First and foremost, emphasis is laid upon the almost complete absence of late personality blunting when lobotomy is limited to cortical connections from the orbital surface, extending back to but not posterior to the anterior clinoids. A most important observation has been made recently in six cases of schizophrenia or depression in which a more radical posterior extension of the undercutting was carried out to a point 1 to 2 cm. posterior to the anterior clinoids, still limited to the junction of gray and white matter. It had not been realized by the writer, and probably by others, how far posteriorly the orbital gray matter may extend with the brain in situ. The extreme posterior orbital (parolfactory-trigonal) area embraces the septal nuclei and subcallosal gyrus and lies directly antero-medial to the uncus in man, and is connected with it by the uncinate fasciculus. Undercutting of this area is bounded posteriorly by the crossing proximal portion of the anterior cerebral artery, superiorly by the anterior commissure and the inferior border of the caudate nucleus, and laterally by the basal cisterns of the middle cerebral artery and antero-medial edge of the temporal lobe approximately 1 cm. anterior to the uncus. In those patients undergoing such radical posterior extension, there occurred severe convulsions initiated by repetitive swallowing, followed by generalized seizures and profound stupor. A series of seizures ensued during the immediate postoperative period without any late seizures. In three cases there occurred a temporary deterioration of social behavior and judgment; and in two cases a wasting of salt with marked lowering of serum sodium to a low of 115 milliequivalents and concomitant increase of urinary sodium. Such manifestations cleared in several days to weeks, with the exception of one aged case with extraneous complications. Results of posterior orbital undercutting are similar to uncal-hippocampal resections[7,8] in their temporary seizure formation, stupor and confusional state. Results are dissimilar in the "salt wasting" occurring in posterior orbital undercutting, and in the severe recent memory loss occurring in bilateral uncal-hippocampal resections. These observations on the physiologic changes resulting from posterior extension of the undercutting are in accord with the temporary profound habit deterioration noted by Freeman and Watts[9] when they performed their radical posterior vertical lobotomy sections, and by Heath[10] in his observations on the profound electrical sensitivity of the septal nuclei. They have caused the writer to reverse his previous stand that no portions of the orbital cortex and adjacent white matter were of grave physiologic importance upon stimulation or isolation.[2]

In patients undergoing the regular orbital undercutting, there is manifest a temporary indolence, lasting for several weeks and the patient requires pushing by the therapist. Certain of the male patients have commented on a noticeable increase in libido continuing for as long as five years in one case. Relief from drug addiction has been outstanding provided psychopathy is not present.

Complications

There have been no operative infections and one death (W.P.) following a coronary thrombosis four hours postoperatively. One elderly patient (C.O.) with auricular fibrillation, previous cerebral embolism and paralysis agitans had an embolism with temporary hemiplegia and stupor during the operation; recovered in one week, only to be followed by a fall and fracture of hip with renewed confusional state and agitation continuing to date, five weeks postoperatively. Temporary confusion, especially nocturnal, and recent memory loss have occurred in eight patients having cerebral arteriosclerosis but

TABLE I:

Patient	Sex	Age	Date of Operation	*Diagnosis*	*Preoperative Symptoms*
1. J.C.	M	60	3/2/53	Severe obsessive - compulsive; depression; cerebral arteriosclerosis.	Guilt feelings; religious absorption; severe arthritis.
2. J.A.	F	26	2/16/53	Obsessive with phobias and facial tic; drug addiction.	Extreme facial grimacing; hospitalized for years.
3. J.B.	M	43	1/4/50	Severe obsessive-compulsive.	Extreme rituals, anxiety and obsessions; prolonged hospitalizations. Failure of insulin and electroshock.
4. M.R.	F	58	7/19/54	Obsessive; depression.	Obsessive thinking with guilt feeling and depressed mood. No hospitalization; no shock.
5. A.B.	M	34	3/19/53	Obsessive-compulsive.	Prolonged hospitalization; at a standstill because of obsessive and somatic phobias.
6. A.M.	M	28	1/18/52	Obsessive-compulsive, extreme; underlying schizophrenia.	Extreme dependence on mother; bizarre immature personality; extreme obsessive-compulsive.
7. L.M.	F	29	1/16/50	Hypomanic with some obsessive-compulsive personality traits; anxiety.	Marked press of speech, amounting to hypomanic symptoms; underlying anxiety and obsessive-compulsive personality; afraid to go out alone, cross bridges or drive car.
8. R.S.	F	26	4/21/52	Obsessive-compulsive.	Extremely narcissistic, selfish, psychoneurotic, indecisive. Required hospitalization.
9. P.N.	M	53	11/15/50	Obsessive-compulsive; agitated depression.	Extremely severe obsessions; multiple hospitalizations; no improvement on EST. Moderate hypertension.
10. W.P.	M	56	4/18/52	Severe anxiety state; drug addiction; myocardial infarction.	Minister with severe psychosomatic anxiety; at a complete standstill in veterans hospital.
11. V.H.	F	46	6/3/54	Psychoneurotic anxiety state with reactive depression.	Multiple hospitals and doctors for years with anxiety, depression and hypochondriasis. Underlying true depression. 28 EST without improvement.
12. A.M.	F	55	2/1/52	Constitutional inferiority; psychoneurosis with hypochondriasis; drug addiction.	Hypochondriasis over headaches; lifelong inadequacy with hospitalizations and multiple doctors; drug addiction.
13. D.A.	M	29	11/3/53	Obsessive-compulsive neurosis; probable underlying schizophrenia.	Longstanding obsessive-compulsive, homosexual obsessions; narcissistic.
14. D.B.	F	25	11/19/48	Obsessive-compulsive neurosis, severe.	Extremely immature young woman; obsessive-compulsive, habit spasm; masturbation; guilt and religious feelings predominant; silly.
15. E.G.	F	35	12/19/53	Obsessive-compulsive with extreme phobias and anxiety; alcoholism and drug addiction.	Phobias, anxiety, extreme tension, alcoholism because of panic states; professor's wife.
16. R.L.	F	64	7/14/54	Obsessive-compulsive with repetitive thoughts.	Post-involutional obsessive thinking with guilt, depression, tension.
17. K.T.	F	28	1/28/54	Pseudo-neurotic schizophrenia with phobias, anxiety and obsessive thinking.	Underlying fears, phobias, habit spasm, marked anxiety, schizophrenia.
18. C.L.	M	54	8/15/52	Pseudo-neurotic schizophrenia; cerebral arteriosclerosis with brain atrophy.	Psychosomatic preoccupations; free-flowing anxiety; fear of body odors; freight conductor by trade; 2 years' continuous hospitalization.
19. H.O.	F	37	2/12/52	Pseudo-neurotic schizophrenia.	Phobia about dirt and illness; ill since mother became psychotic 2 years previously; much anxiety; at a standstill.

OBSESSIVE-COMPULSIVE AND ANXIETY-TENSION STATES:

Results		
Symptomatic	*Degree*	*Convulsions*
Tempbrary confusion with auricular fibrillation. Immediate improvement; nocturnal confusion slowly subsided.	Moderate. 2 plus.	0
Immediate improvement; lives at home; drives car; habit spasm much improved.	Marked. 3 plus.	0
Dramatic improvement with return to full-time work maintained to date.	Marked. 3 plus.	0
Dramatic relief from obsessive thoughts and lift in mood at end of operation. Discharged home on 7th day.	Marked. 3 plus.	0
Steady improvement, reluctantly admitted. Marked increase of libido. Continuing to date; home at full-time work.	Marked. 3 plus.	0
Slow continuous improvement, first in tension; more rapid after 3 months when he obtained job; has continued at work; end results excellent.	Marked. 3 plus.	0
Slow progressive improvement; now drives car alone, crosses bridges; weight gain; anxiety and obsessive traits markedly improved; still has press of speech.	Moderate. 2 plus.	0
Slow continuing improvement 1 year postoperatively, permitting her to move from sanatorium to farm to home. Gain of weight.	Marked. 3 plus.	0
Immediate relief from anxiety and obsessions; temporary apathy; facial tic much improved. Returned to practice of law. Hypertensive cerebral hemorrhage and death 14 months after operation.	Marked. 3 plus.	0
Immediate lift of mood and anxiety. Acute myocardial infarction with immediate death while patient sitting on toilet day of operation.	Death.	0
Radical undercutting carried more posteriorly than usual. Temporary stupor and nocturnal confusion 72 hours postoperatively, clearing thereafter. Discharged home on 10th day markedly improved from preoperative status. Readmitted with head injury and wound burst open following probable seizure. Seriously ill for 1 week. Again marked improvement with second discharge 1 month postoperative.	Marked. 3 plus.	Seizure 11th postoperative day. Series of seizures after head injury.
Good for anxiety and somatic conversion phenomena and drug addiction. Poor for underlying constitutional inferiority. Remains selfish, critical and demanding. Just able to remain out of hospitals.	Moderate. 2 plus in neurotic symptoms. Slight. 1 plus in personality deficit.	0
Temporary indolence requiring pushing. 3 months postoperatively: lives at home; drives car; has lost hostility; has never mentioned homosexual obsessions; slight untidiness; no deterioration.	Marked. 3 plus.	0
Extra-conservative orbital undercutting; first such operation done. Improved in social activities. Stuttering and compulsive scratching of body improved but remainder of symptoms continue especially habit spasm. At home.	Slight. 1 plus.	1 seizure 2 years postoperatively.
Discharged home in 1 month; obtained job in 4 months. Has drunk only one time since operation. Much less anxiety and tension. Lives at home alone when husband is on lecture tours.	Marked. 3 plus.	0
Immediate cessation of repetitive thoughts. Lift in mood; lessening of anxiety. Discharged in 1 week to her home.	Marked. 3 plus (early)	0
Much improved in tension, anxiety, phobias, insomnia, but only slightly in schizophrenia. Less silly; unable to remain out of hospital.	Moderate. 2 plus neurotic symptoms. 0 in schizophrenia.	0
Temporary confusion; immediate improvement in tension and anxiety; back to work 8 days postop; more indolent; doing well at last report 6 months postoperatively.	Marked. 3 plus.	0
Immediately improved in mood and anxiety; slowly subsiding indolence and lack of imagination. By end of 2 years, cheerful, happy, runs the house, normal life.	Cured. 4 plus in neurosis. Marked. 3 plus in schizophrenia.	0

TABLE I:

Patient	Sex	Age	Date of Operation	*Diagnosis*	*Preoperative Symptoms*
20. J.M.	M	60	11/19/51	Pseudo-neurotic schizophrenia with tension and anxiety; cerebral arteriosclerosis.	Increasing tension, anxiety, hypochondriasis; moderate depression; very withdrawn, schizoid personality of high intelligence; arteriosclerotic. EST had not helped. Prolonged hospitalizations.
21. E.D.	F	39	2/4/50	Pseudo-neurotic schizophrenia.	Chronic tension with underlying schizoid features.
22. L.K.	M	28	6/6/49	Pseudo-neurotic schizophrenia.	Vagueness in thinking; flat affect; good contact; obsessive thinking and tension. Hospitalization.
23. R.B.	M	25	4/9/51	Pseudo-neurotic schizophrenia.	Obsessions, anxiety, psychopathic trends of many years. EST gave temporary improvement. Requested operation.
24. M.H.	F	30	5/2/50	Pseudo-neurotic schizophrenia.	Attractive mother of 2 children. Emotionally flat and withdrawn; tense; obsessive; reactive depression with crying. Temporary improvement with shock.
25. V.L.	F	70	5/21/52	Conversion reaction; cerebral arteriosclerosis.	10 years illness; rigid personality; obsessed with tinnitus; insomnia; phobias.
26. S.B.	F	81	5/27/52	Agitated depression; severe neurotic with somatic conversion state; cerebral arteriosclerosis.	Agitation and insomnia intolerable to relatives, requiring hospitalization.
27. M.M.	M	65	1/26/53	Obsessive compulsive; somatic conversion state.	Obsessed with tinnitus; 2 courses preoperative shock without benefit; several hospitalizations.
28. G.D.	M	70	7/21/53	Obsessive compulsive; Parkinsonian disease; cerebral arteriosclerosis.	Parkinsonism, nocturnal confusion, coronary attacks, suicidal attempt. EST increased confusion.
29. K.P.	M	65	4/16/52	Agitated depression; cerebral arteriosclerosis, severe.	Recurrent depressions for 20 years with hospitalizations; suicidal risk; poor results with shock; previous "stroke."
30. W.F.	M	69	7/7/54	Depression; cerebral arteriosclerosis.	2 previous depressions; electroshock caused too much confusion.
31. H.M.	M	71	4/8/54	Obsessive; depression; cerebral arteriosclerosis.	Severe brain atrophy; prolonged hospitalization.
32. M.R.	F	84	10/7/52	Agitated depression; cerebral arteriosclerosis.	Prolonged hospitalization with death wishes and deep depression.
33. L.R.	M	70	4/21/54	Depression; cerebral arteriosclerosis.	3 previous depressions; obsessive personality type.
34. N.T.	F	76	1/5/53	Anxiety state; conversion hysteria; drug addiction; cerebral arteriosclerosis.	Former superintendent of hospital; hospitalization.
35. A.L.	F	68	2/9/54	Agitated depression; obsessive-compulsive.	15 years of obsessive-compulsive state with recent severe depressions, insomnia and confusion. No shock.
36. P.R.	M	69	9/29/53	Obsessive-compulsive; depression.	At a standstill with prolonged hospitalization.
37. A.L.	M	67	2/15/54	Obsessive-compulsive; depression; cerebral arteriosclerosis.	Psychotic family history; lifelong obsessive-compulsive with recent depression; obsessed with cellar pipes dripping; temporary improvement with shock treatment.
38. C.O.	F	68	6/9/54	Agitated depression; degenerative encephalopathy; Parkinsonism; previous cerebral embolism.	Auricular fibrillation; previous cerebral embolism with hemiplegia and Parkinsonian signs.

OBSESSIVE-COMPULSIVE AND ANXIETY-TENSION STATES:

Results		
Symptomatic	*Degree*	*Convulsions*
Forgets grimaces and obsession with "wheels in head" when occupied and interested; lives at daughter's home; periods of apparent normalcy with sociability and lift in mood; alternate periods of depression, possibly associated with progress of "romantic interest."	Marked. 3 plus.	0
Immediately postoperatively, quiet, relaxed, cooperative. Regression to preoperative status. Still institutionalized.	None. 0	0
Early results: less tension and obsessive thinking. Late results: marked improvement, extensive psychotherapy with narcoplexus. At home, working full-time.	Marked. 3 plus.	0
Follow-up at 1 year: lifting of anxiety and panic states. Operation considered worthwhile by his physician.	Moderate. 2 plus.	0
Immediate lift of anxiety, tension and depression; indolence; lessening of obsessive "counting." 2 months postoperatively admitted for first time, "believed grandmother's spirit looking over right shoulder and people are outside of second-story window" without much affect towards same. 1 year later cheerful; "feels left arm is not there." Caring for her children; less ambitious. 3 years postoperatively, no depression, delusion of having cancer; 4 years postoperatively, still able to maintain home and care for children in spite of schizoid delusions.	Moderate. 2 plus.	0
Steady improvement to date.	Marked. 3 plus.	0
Dramatic improvement. Happy at home.	Cured. 4 plus.	0
No further mention of tinnitus; home, contented to date.	Marked. 3 plus.	0
Operation increased confusion temporarily with immediate relief in depression, anxiety and obsessive thinking. Confusion regressed for 6 months. Now slowly progressing to senility and disorientation; contented in nursing home.	Marked. 3 plus.	0
Immediate lift in mood; no deterioration; home; driving car; minimal personality change of irritability and memory loss; working part-time.	Marked. 3 plus.	0
Marked improvement in depression. Convalescent home in one week.	Marked. 3 plus.	0
Perverse refusal to admit improvement. No deterioration. Actually less tense, more cheerful. Still compulsive. Discharged home 3 months postoperatively.	Slight. 1 plus.	0
Immediate relief from desire to die and agitation. To convalescent home. Contented. Now senile deterioration at 86 years.	Marked. 3 plus.	0
Discharged on 7th day. Full-time work in mechanical engineering. His golf reflects his improvement in mood.	Cured. 4 plus.	0
Cured of drug addiction, agitation and insomnia. No deterioration. Happy in nursing home.	Marked. 3 plus.	0
Dramatic lift of agitated depression; 2 days of euphoria. Home in 1 week. Completely normal to date.	Cured. 4 plus.	0
Immediate lift in mood and lessening of rituals and extreme obsessions. Discharged in 3 months. Full-time work as chairman of board of insurance company.	Marked. 3 plus.	0
Immediate improvement; weight gain. Ceased visiting cellar after two months. 1 plus personality deterioration with slight euphoria and irritability.	Marked. 3 plus.	0
Radical undercutting probably extending behind anterior clinoids. Cerebral episode with coma and temporary hemiplegia terminal and of operation. 3 days' stupor. Extreme fall in serum sodium clearing in 10 days. Focal seizures for 12 hours postoperative. Immediate improvement in depression. Confused the first week, then well oriented. Fell and broke hip, followed by recurrence of confusion and agitation, slowly clearing again 6 weeks' postoperatively.	Temporary benefit with relapse. 0	Operative, lasting 12 hours.

TABLE I:

Patient	Sex	Age	Date of Operation	*Diagnosis*	*Preoperative Symptoms*
39. M.L.	F	77	3/19/54	Depression; rigid, compulsive personality; cerebral arteriosclerosis.	Lifelong obsessive personality; reactive depressions following moving; impossible to live with.
40. R.P.	M	73	1/11/54	Depression with obsessions; cerebral arteriosclerosis.	Prolonged hospitalization; severe depression following amputation left leg for gangrene; obsession over his stump. No improvement with shock.
41. E.C.	F	77	4/28/49	Recurrent agitated depression.	Recurrent depressions 15 years with 1 suicidal attempt. Temporary improvement with shock.
42. E.E.	F	43	8/17/50	Conversion hysteria.	Longstanding panic, anxiety, hysteria, hypochondriasis. Multiple operations for 25 years. Multiple hospitalizations. Obsessive features and silliness.
43. A.F.	M	48	4/12/51	Conversion neurosis.	Fixation on low-grade headaches, chronic running ears. Out of work for previous year. Intractable to psychotherapy.
44. B.G.	F	61	10/12/50	Involutional depression; lifelong obsessive-compulsive; cerebral arteriosclerosis.	Previous hospitalization.
45. V.R.	F	43	2/4/50	Recurrent depressions; underlying schizophrenia.	Intermittent hospitalizations 15 years; 3 suicidal attempts; paranoid schizophrenic features.
46. G.M.	M	52	7/28/53	Depression with suicidal attempts; inoperable carcinoma of left lung; drug addiction.	Hospitalized.
47. R.C.	F	47	2/21/51	Recurrent depressions with tension state.	Recurrent depressions over 10 years with tension. Shock treatment gave temporary improvement. 1 suicidal attempt.

TABLE II

Results of Orbital Undercutting in Psychoneuroses, Depressions and Senile Emotional States

Degree of improvement is derived from the averaged opinions of the patient, relatives, psychiatrist, nurses, and writer. Significant improvement includes moderate, marked, and "clinical cure" categories.

Category	*No.*	*Degree of Improvement*	*Significant Improvement*
Obsessive-compulsive and anxiety-tension states	16	11 marked 3 moderate 1 slight 1 death	14 out of 16 cases
Pseudo-neurotic schizophrenia	8	1 "clinical cure" 4 marked 2 moderate 1 unimproved	7 out of 8 cases
Senile emotional states (depressions (obsessive-compulsive	17 13) 4)	4 "clinical cures" 10 marked 2 slight 1 unimproved	14 out of 17 cases
Somatic conversion states	2	2 moderate	2 out of 2 cases
Depressions	4	4 marked	4 out of 4 cases
TOTAL	47		41 out of 47 cases or 87%

OBSESSIVE-COMPULSIVE AND ANXIETY-TENSION STATES:

Results		
Symptomatic	*Degree*	*Convulsions*
Dramatic immediate cure of symptoms. Invited to live with friends. "As she was 15 years ago."	Cured. 4 plus.	0
Immediate relief from depression; mild recurrence; slow steady improvement thereafter. Temporary auricular flutter, not present preoperatively. Discharged home at 2 months. Wearing prosthesis for first time since amputation 1 year previously.	Marked. 3 plus.	6 grand mal seizures night after operation; none since.
One of the earliest cases. Operation less completely performed. Temporary mood improvement with regression after first month. Continuing unhappy and hypochondriacal. No deterioration; no further talk of suicide.	Slight. 1 plus.	0
7 days of overt hostility. Last report 3½ months postop: doing own housework; at home; cheerful but still has multiple somatic complaints and loath to admit improvement.	Moderate. 2 plus.	0
Initial multitude of new somatic complaints, increased irritability. Slow steady improvement thereafter, indicating a temporary release of hostility. Patient loath to admit improvement; wife states much improved. Returned to work approximately 1 year postoperatively and works 6 months out of 12 in past 2½ years.	Moderate. 2 plus.	0
Home postoperatively and contented to date.	Marked. 3 plus.	0
Immediate improvement in depression; slow improvement in schizophrenia; late results after 6 months excellent. Normal life at home to date; working.	Marked. 3 plus.	At end of operation for six hours following uncus stimulation.
Cured of addiction and depression; home 1 month postoperatively; continuing well to date.	Marked. 3 plus.	0
Immediate relief from anxiety. Discharged home in 1 month. Report 2½ years postoperatively: excellent late results; lives at home; cares for house; good spirits; less tension.	Marked. 3 plus.	0

cleared in several days to several weeks time. Likewise, slight temporary irritability or euphoria has been present in the older patients, clearing in several months' time. These findings appear to be dependent upon the degree of arteriosclerosis and upon the posterior extension of the undercutting. Isolated convulsions occurring more than one week after operation have appeared in a known two patients and possibly more have not been recognized. This constitutes less than one-half the number occurring in the writer's series of standard open lobotomies. All but one have been permanently arrested on dilantin therapy, and none have constituted a social disability because of their nocturnal appearance. With the exception of five cases of radical posterior extension of the undercutting, temporary incontinence has occurred only in the very old and in only one case, age 82, has it been permanent. There is a discernible social insensitivity occurring in those patients undergoing radical extension of the orbital undercutting behind the anterior clinoids.

Discussion

Neuroses and mood disorders constitute our most common illnesses. Obsessive compulsive neuroses are resistant to both electroshock and psychoanalysis. Senile mood disorders frequently prevent the use of electroshock because of age. A form of limited lobotomy which can give appreciable symptomatic relief with preservation of an intact personality is to be desired. Newer types of limited lobotomies, giving such symptomatic benefit, are appearing in increasing numbers.[2,4,11,12,13,14] Operative preference should rest on the following criteria: symptomatic benefit; complete preservation of personality; and sufficient quantitative

precision to permit the exact duplication of the physiologic results in successive cases. The method of undercutting of the orbital cortex under direct vision over a measurable area appears to satisfy these criteria. Selection of cases should include only those patients possessing an exaggerated social sensitivity and conscience rather than a constitutional lack, because even limited lobotomies are destructive, and benefit results from a reduction rather than a replacement of function. In addition to causing no appreciable late personality blunting, a lobotomy limited to the orbital cortical connections appears to have a specific effect on mood and visceral consciousness, thereby especially affecting true depressions and the psychosomatic aspects of neuroses. It is recommended that the radical posterior extension be reserved for only severely ill schizophrenic patients in which cases it may well be necessary for the accomplishment of lasting improvement. In elderly patients and those with severe cerebral arteriosclerosis, a more conservative undercutting is advised, extending not more than 5.5 cm. posterior to the frontal poles. This will prevent temporary memory loss, nocturnal confusion, and loss of social sensitivity.

Summary

1. Presentation is made of 47 cases of intractable psychoneuroses, depressions and senile emotional states undergoing undercutting of the orbital cortex of the frontal lobes.

2. The undercutting operation permits precise sectioning under direct vision of a measured extent of cortical connections and can be exactly duplicated in successive cases.

3. When limited to the orbital cortex, there is no appreciable late blunting of personality even in the elderly.

4. 87% of the patients have shown significant improvement with a gratifying diminution of anxiety, tension and obsessive thinking, a lift in mood, and a lessening of visceral consciousness.

5. Optimum results have unexpectedly occurred in the older age group, sufficient to warrant a separate report.

6. Operation may uncover an underlying schizophrenia in pseudo-neurotic schizophrenic patients.

7. Physiologic observations are made on the functions of the extreme posterior portion of the orbital cortex.

Acknowledgment is made to the doctors listed below for their referral of the majority of the 47 cases of psychoneuroses, depressions and senile emotional states, described in this paper, and appreciation extended for their aid and interest in studies on their patients.

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The Funkenstein Test as a Guide to Treatment in the Neuroses and Psychoses

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In the unceasing search for a better psychophysiologic understanding of the etiology of mental illness, an interesting development has occurred. Investigators have found that autonomic nervous system stimulation has produced blood pressure reactions which aid in selection of therapy and prognosis in treatment of psychiatric disorders.

In 1948, Funkenstein, Greenblatt and Solomon[4] published their first paper on autonomic changes following electric shock treatment. Through using epinephrine intravenously and mecholyl intramuscularly and recording the blood pressure responses as well as the psychological responses they found patients of different diagnostic categories fell into seven different patterns. None of the responses was characteristic for any diagnostic group, but they found patients in two of the groups with a deficient capacity to establish blood pressure homeostasis responded well to electric shock therapy, while those in other groups showed poor response. They were able to show a correlation of the autonomic group responses with certain clinical entities. In subsequent papers[5,6] they demonstrated that marked changes occurred in the functioning of the autonomic nervous system following EST which had a definite correlation with the clinical improvement of the patient. This led to the postulate[8] that if a patient's psychologic picture doesn't change, neither does his physiologic, regardless of whether brought about by psychotherapy, insulin shock, EST or spontaneously.

On the basis of the research carried out over the past six years, Funkenstein and coworkers[7,10] felt able to predict a good outcome from EST in patients who show either an autonomic nervous system grouping of VI or VII, an anxiety precipitated or relaxed by mecholyl, or a chill after mecholyl stimulation.

Gellhorn[11] in a discussion of these tests associated the effect of mecholyl stimulation of blood pressure with hypothalamic activity. He indicated that a hypotensive reaction to mecholyl with failure to reestablish homeostasis of blood pressure occurred with a reduction of response of the hypothalamus. If the blood pressure quickly returns to normal following mecholyl stimulation, a state of increased hypothalamic activity exists. The latter would correspond to Autonomic Groups I through IV while the former would correspond to Groups VI and VII. In a further discussion he pointed out that CO_2 inhalation in high concentrations reduces hypothalamic activity, hence CO_2 therapy should be most effective in Groups I through IV.

This response of autonomic nervous system reactions, therefore, should provide a simple, rapid means of selecting early the most effective type of treatment for both psychoneurotic and psychotic patients seen in the course of outpatient and office psychiatry. The following study was carried out to test this formulation.

Method

Over the period of one and a half years the autonomic nervous system test was administered to sixty-one new patients following their first office interview and before their second office appointment was made. As the patient concluded his first office interview he was told he would have a test which would help in further diagnosing his difficulty and would involve observing his response to certain medications. The patient came to the testing situation and this was repeated. In addition he was told the test would aid in selecting the best type of treatment for him. He was told he may or may not feel any effect from the medication. The method of testing followed that outlined by Funkenstein, Greenblatt and Solomon.[10] After the patient had been lying down in a

From the A. E. Bennett Neuropsychiatric Research Foundation and Department of Psychiatry, Herrick Memorial Hospital, Berkeley, California.
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quiet, darkened room for at least thirty minutes, and two hours after the last meal, the blood pressure was taken by the cuff and ausculatory method by a nurse. The doctor then injected 1 c.c. of isotonic solution of sodium chloride intravenously and the systolic blood pressure was followed for ten minutes. Immediately following this 0.025 mgm of synthetic epinephrine in 0.5 c.c. of isotonic saline was injected intravenously, and the systolic blood pressure was followed until it returned to the preinjection level, usually within four to eight minutes.

On the second day, under similar basal conditions, and following the isotonic saline injection, the patient was given 10 mgm of mecholyl chloride intramuscularly, and the systolic blood pressure was followed for twenty-five minutes.

All subjective experiences, both physical and emotional, were noted during the test, and at the conclusion of each test the patient was questioned specifically about anxiety and as to whether or not it was similar to his spontaneous attacks. It was also noted whether or not anxiety was relaxed by either drug. Before the patient left his last testing situation, his next office appointment was made. He was also told that his reactions to the medications were the responses of his condition as it existed at that time and it was suggested that the same test repeated at a later time, after therapy, might show a completely different type of response.

Twenty-four patients have been retested after therapy, using the same technique as above.

Results

Using the systolic blood pressure as the ordinate and the time in minutes as the abscissa, graphs were constructed of each patient's reactions to the saline, epinephrine and mecholyl. The blood pressure responses seemed to be easily classified in the six basic groupings later determined by Funkenstein and co-workers,[10] as seen in Fig. 1. It should be noted that the mecholyl response of the first three groups rapidly returns to homeostasis after a brief fall, with even a compensatory rise, and generally a marked rise in pressure with epinephrine. Group V shows only a mild epinephrine response with a mild mecholyl response which does not return to preinjection level, while Groups VI and VII show moderate epinephrine responses and marked hypotensive effects with mecholyl and failure to return to preinjection level. Group VII is further characterized as being associated with a shaking chill occurring between 11 and 23 minutes after injection of mecholyl. Three patients tested were not included in this study because of a paradoxical response to mecholyl, showing a rise in pressure initially followed by a brief fall and rapid return to preinjection levels. This finding has been noted by several independent observers,[3] and as yet its significance is undetermined.

The psycho-physiologic responses were found to fall in five groups: (1) those who showed no precipitable anxiety with either epinephrine or mecholyl; (2) those with epinephrine precipitable anxiety alone; (3) those with mecholyl precipitable anxiety alone; (4) those with anxiety precipitated by both drugs and (5) those with a chill following mecholyl injection.

The patients tested fell in various diagnostic categories. Diagnosis was clinically determined either at termination of treatment or during long term therapy. The majority of cases fell in the group of psychoneurotic reactions, while sociopathic personality disorders, convulsive disorders, schizophrenic reactions and manic-depressive reactions constituted the smaller group

TABLE I

Distribution of 61 Cases in Various Diagnostic Categories in Relationship to 6 Autonomic Groups.

Diagnostic Categories	*Funkenstein Reaction Groups*					
	I	II-III	IV	V	VI	VII
PSYCHONEUROTIC REACTIONS TOTAL 49						
Anxiety Reactions	5	5	8	2	5	6
Phobic Reactions					1	3
Conversion Reactions	2		1	2	2	2
Depressive Reactions			1			4
SOCIOPATHIC PERSONALITY DISORDERS TOTAL 4		1	1	1		1
CONVULSIVE DISORDERS WITH ANXIETY TOTAL 2				2		
SCHIZOPHRENIC REACTIONS TOTAL 2			1	1		
MANIC-DEPRESSIVE DEPRESSED TOTAL 4	1	1			1	1

of patients. Table 1 shows the relationship of the diagnostic categories to the autonomic groups. Anxiety reactions are distributed over all groups, as are conversion reactions. Phobic reactions are seen to fall in Groups VI and VII, while depressive reactions show primarily Group VII responses and only one falls in Group IV. In total response, there is an apparent predominance of Group VII responses in the psychoneurotic patterns, with Group IV as the next frequent pattern.

Following the testing situation, the patients were carried on in therapy with that form of treatment most desirable on a clinical basis, without reference to the autonomic grouping. The forms of treatment used were psychotherapy, carbon dioxide therapy, electroshock therapy, combined insulin and electroshock therapy, and anti-convulsant medication with psychotherapy. Fifty-nine of the patients continued treatment as office patients and only two patients were hospitalized subsequent to the first interviews.

The psychotherapy varied from short term therapy to more prolonged intensive psychotherapy. Carbon dioxide therapy was administered after the standard of procedure outlined by Meduna,[14,15] using 30 per cent CO_2 with 70 per cent O_2 mixture. In the cases receiving electroshock therapy, one patient was hospitalized, three patients were treated as outpatients. The patient receiving combined insulin and electroshock therapy was hospitalized for treatment. In all cases the electroshock was applied following the intravenous injection of d-Tubocurarine for maximum muscular relaxation.

Response to therapy was considered as improved when the patient became clinically

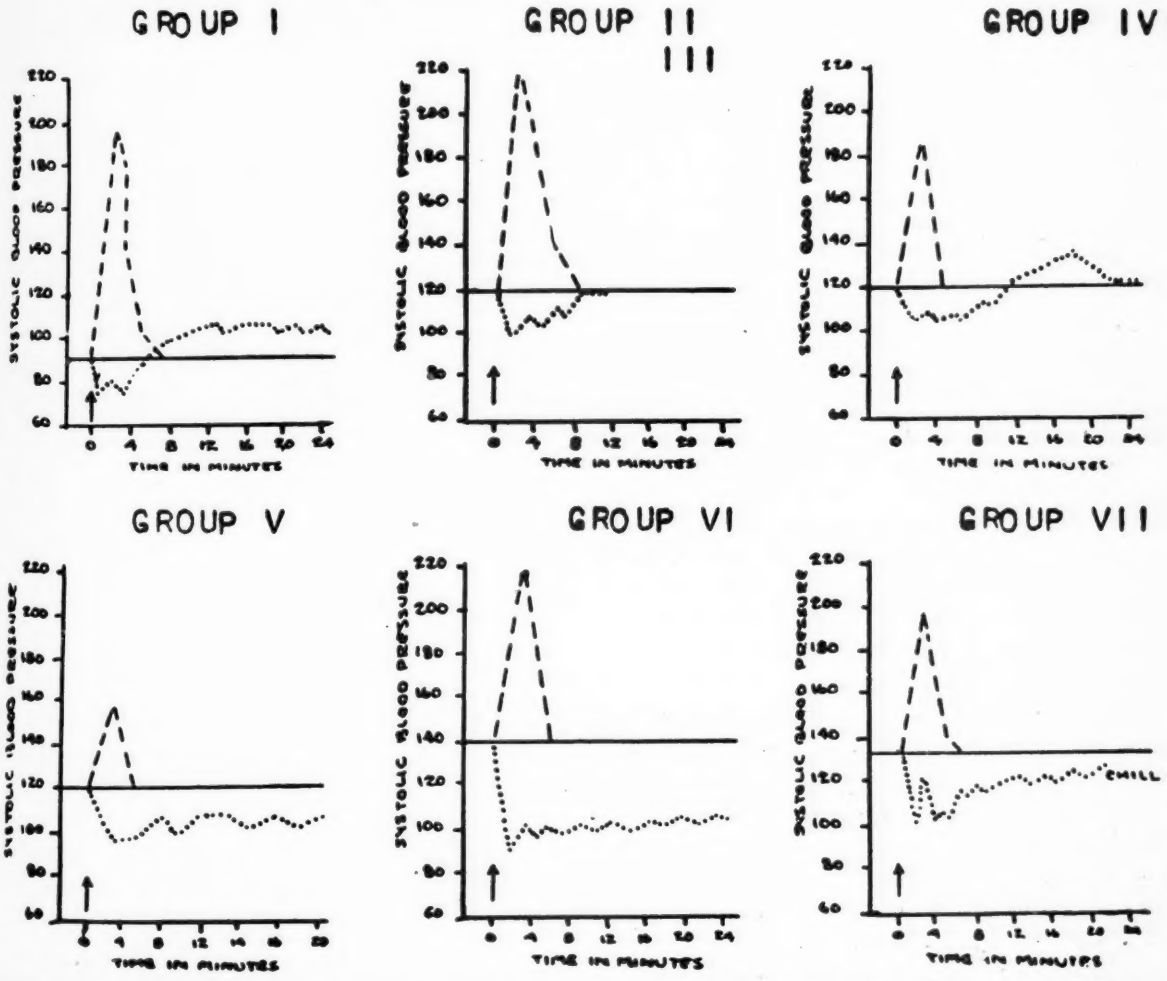

Fig. 1. Six varieties of blood pressure response to intravenous epinephrine (0.025) and intramuscular mecholyl (10 mg.).

and subjectively well and remained that way for over a month after cessation of treatment. In the cases of long term psychotherapy, response was considered improved on the basis of clinical and subjective evidence of better life adjustment and interpersonal relationships. Patients were considered as unimproved who showed a relapse with termination of treatment or who failed to show any change under treatment.

TABLE II

Response to Different Forms of Therapy of the 6 Autonomic Groups.

Type of Therapy	*Funkenstein Reactions*					
	I	II-III	IV	V	VI	VII
PSYCHOTHERAPY						
Improved—39	5	3	9	3	5	14
Unimproved—9	3	2	1	2		1
CARBON DIOXIDE THERAPY						
Improved—6		1	2	1	1	1
Unimproved—2		1			1	
ELECTROSHOCK THERAPY						
Improved—4					3	1
Unimproved—0						
INSULIN AND ELECTROSHOCK COMBINED						
Improved—1			1			
ANTICONVULSANT MEDICATION WITH PSYCHOTHERAPY						
Improved—2				2		

In Table 2 it can be seen that of the 48 patients treated with psychotherapy alone, 39 improved while 9 failed to improve. Of this latter group, 8 of the patients have been in therapy less than three months and one patient quit after two interviews.

Improvement in psychotherapy occurred in all groups but the largest number of cases fall in the Groups IV, VI and VII. The percentage of improvement in the other three groups is seen to be only slightly above 50 per cent.

Of the cases treated with carbon dioxide therapy, the improvement did not seem to have any particular relation to autonomic groups. The four cases treated with electroshock therapy fell in the favorable groups for this therapy and all four cases improved. The single case treated with combined EST and insulin fell in Group IV and showed improvement. It is interesting to note that the two cases of convulsive disorder tested and treated with improvement fell in Group V, which is considered by Funkenstein and his group as predominantly associated with schizophrenic reactions and with a poor prognosis.

It is not within the scope of this paper to discuss the results of the repeat tests, except to state that where psychologic change had occurred, physiologic change was also found.

Discussion

This study showed a high correlation between the outcome of treatment of various types, principally psychotherapy, and data derived from blood pressure reactions in response to adrenergic and cholinergic stimulation. The work of Funkenstein, Greenblatt and Solomon is corroborated by the findings that (1) autonomic reactions have no specific correlation with diagnostic groupings; (2) psychologic changes are followed by physiologic changes; (3) those few cases in this study treated with electroshock therapy fell in the groups with most favorable prognosis for this therapy and improved. The responses to carbon dioxide therapy did not particularly follow the theory previously mentioned of Gellhorn. Psychotherapy showed improvement in all groups, but predominantly in three groups. Electrostimulation has been found effective in Groups I-IV whenever anxiety is present by Alexander.[1] What is a possible explanation of the psychoneuroses with certain types of autonomic nervous system reactions having a better response to psychotherapy than other groups? In the search for the association between the psychopathologic structure of personality and the psychophysiologic responses much has been contributed by the simple study of response to epinephrine and mecholyl. Lindemann and Finesinger[12] found that anxiety stimulated by mecholyl was characterized by good contact and rationalizing ability. Bockoven and co-workers[2] demonstrated that in chronic and acute schizophrenics, those with parasympathetic dominance tended to show constructive activities and better socialization. Meadow and his group[13] found that patients with the best capacity for abstract thinking showed the more marked fall in pressure with mecholyl and failure to return to homeostasis. Funkenstein, Greenblatt and Solomon[9] suggest the responses of marked mecholyl re-

action resemble Cannon's fight-flight responses. In this study, those psychoneurotic reactions showing the most marked mecholyl responses also showed the best responses to therapy. As yet there is no completely satisfactory explanation for this fact.

It is, however possible to suggest that there is in this simple test a very practical application to selection of therapy and prognosis. Alexander[1] points out that the use of this simple test "enables one to steer the patient through the scylla of anxiety on the one hand and the charybdis of depression on the other." This is confirmed by this research and demonstrated to be feasible in the private practice of psychiatry.

Summary and Conclusions

1. Sixty-one patients, predominantly psychoneurotic reactions were tested with epinephrine and mecholyl before therapy was instituted. Twenty-four patients had repeat testing done after termination of therapy. On the basis of their blood pressure reactions, they could be divided into six groups which showed no particular correlation to diagnostic category.

2. Thirty-nine of 48 cases showed improvement under psychotherapy and improvement was noted to be greatest in those patients with a marked fall in blood pressure following mecholyl. This same reaction pattern showed improvement with electroshock therapy in depressive and manic-depressive reactions. Carbon dioxide therapy was found to have no specific correlation of improvement with autonomic grouping.

3. It was suggested that this psychophysiologic test constitutes a simple, practical measure for aid in selection of therapy and prediction of prognosis and can be carried out quite adequately in an office practice.

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The Habit of Not Returning Books

A Contribution to Half-Accepted "Social Stealing"

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Please return this book; I find that though many of my friends are poor arithmeticians, they are nearly all good bookkeepers.

Sir Walter Scott.

The perennial habit of not returning books seems at first glance to be self-explanatory. Some people start their libraries in that way: as Sydney Smith said, "No furniture is so charming as books, even if you never open them or read a single word."

Nevertheless, there is a problem involved. Why do people who are otherwise passably correct in their conduct, who would never do anyone out of three dollars (or at least not openly), fall from grace when the property involved is a three-dollar book? Why the sudden departure of all scruples? Why exactly when dealing with a book? And what explains the tantrum of the bereft owner when he realizes his loss?

There is another sphere in which books seem to have an unfortunate effect upon probity. Wilson Mizner correctly observed: "I know of no sentence which can induce such brazen and immediate lying as the one which begins, 'Have you read . . .' "

There are very few intelligent people who will openly admit that they do not read books, and fewer who will brag about it. The fact remains that a considerable number of people seldom do read. I know of only two examples of frankness on this point. Both candid gentlemen move in literary circles; their frankness is probably affectation or witticism. The novelist John O'Hara recently stated that he never reads a book, since his interest in literature is confined to studying each successive issue of *Who's Who*. Oscar Levant paraded his lack of interest with the wisecrack: "I've given up reading books; I find it takes my mind off myself."

To complicate matters, the habit of borrowing and not returning books seems to have been observed by many generations. It was popular in Scott's day, as the plea quoted above attests. Charles Lamb, too, complained furiously: "Borrowers, those mutilators of collections, spoilers of the symmetry of shelves, and creators of odd volumes . . ." There is even a record of Montaigne's reaction: "It is easier to keep a book than its contents." When one considers that the printed word is hardly rounding out its fifth century, the record of "social stealing" of books seems to be quite complete.

In studying an irrational situation it is often of value (to use an understatement) to refer to infantile precursors.

For the child, all printed matter is an adult mystery, and awe-inspiring to boot. For years the child cannot read, but he sees adults doing so. A remnant of this early awe is observable in all adults. Printed matter has the stamp of authority. Even nonsense, when printed, has an emotional connotation different from that of spoken nonsense.

Printed books (not picture books) enter the child's life as a duty. The fact that mastering the art of reading challenges the child's megalomania, and that the challenge helps him to master the skill, is another matter.

Later on, the single-mindedness of the early attitude to reading disappears. After having learned to read for pleasure, the child will want to read the funnies or the sport page at a time when he should be doing his "required" reading for school. The typical family conflict ensues. Reading for pleasure and reading as a duty become distinct entities.

What is the situation in which a book is borrowed? The host mentions the book, or the guest sees it on the shelf. Externally,

the situations seem dissimilar, but they are identical psychologically. The mere presence of the book on the shelf constitutes an implied reproach: "Why don't you read?"

Because of this unspoken reproach, all reading matter borrowed socially is unconsciously classified under "reading as a duty." Paradoxically, this even applies to a book which the guest *consciously* would have liked to read, if it had come into his hands under different circumstances.

As soon as a book is classed as duty-reading, the old childish rebellion against duty ("Why don't you do your homework?") comes back into operation. Endless procrastination results, or is simulated, for even if the book has been read but not returned the impression is created that it has not been opened.

This infantile situation, activated by the fantasy of "duty-reading," is Act One in the unconscious repetition. It explains why some borrowed books are never read, but retained indefinitely with the help of the rationalization, "I'll get to it, in time."

Act Two explains why social stealing of books leaves the pilferer with a clear conscience. As already mentioned, even otherwise correct people relax their standards in this situation. Once more, the reason is in no way connected with correctness or incorrectness in social contacts. Behind this deviation lies a very primitive infantile (and repressed) fantasy: "If you, mother (or father) want me to read, you'll have to give me the book." Who ever heard of a child of six paying his father for schoolbooks? Or returning them, for that matter?

By applying these infantile yardsticks, connected with the initial inner misunderstanding ("duty-reading"), the borrower accentuates his "moral right" to keep the book. In another layer, his failure to return the book is a means of punishing the lender for having forced the book on him. Objectively, of course, the lender may not have wanted him to borrow the book at all. That is of no importance; his role is rewritten to fit into the infantile circle.

One could also mention that "social stealing" is not always passed off graciously, although it is seldom mentioned. The borrower provides himself with a small helping of masochistic pleasure by incurring the lender's half-revealed indignation. On the other hand, he prefers to take the blame for the "lesser crime"; instead of admitting his half-neurotic masochistic infantile repetition, he presents his semi-aggressive act as a defense. Both defenses are of course unconscious.

The lender's attitudes and reactions are hardly less curious than the borrower's. For example, one often sees the facetious bookplate: "Stolen from the library of . . ." On the conscious level, this is a stern warning; on the unconscious level, it is an open invitation. Why do owners hesitate to make a direct demand for the return of their books? Why does the characteristic temper tantrum almost invariably take place behind the perfidious borrower's back? Apparently the lender unconsciously welcomes the borrower's felony, and does his best to compound it.

A patient who became eloquently furious about his friends' and acquaintances' "stealing of books" consoled himself, when in a sarcastic mood, with the hope that the increasing popularity of paper-bound books selling at thirty-five cents would eliminate the entire problem. He had too high an opinion of his friends, he said, to believe they would commit so small an offense. "More likely," I retorted, "social stealing will increase. The borrower will tell himself that thirty-five cents cannot matter. Since infantile mechanisms are involved, external circumstances can make very little difference."—"What other solution can you suggest?" asked the indignant man.—"Well, since most of your friends are young writers like yourself, there is still hope for you. Experience proves that established writers and older writers read little. And there is, perhaps, a good reason for that, as Will Rogers pointed out when he said: 'In Hollywood the woods are full of people that learned to write but evidently can't read; if they could read their stuff, they'd stop writing.'"

The Menstrual Cycle and Recovery During Shock Treatment

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Attempts at finding a reasonable physiological explanation for the therapeutic effects of the shock treatments have thus far failed to yield more than fragmentary information. The complete theories of mental illness and its treatment evolved in these investigations are numerous and varied and often not supported by the actual data. The investigations do confirm the occurrence of important physiological changes during treatment and suggest that much remains to be learned about shock therapy. Our contribution aims at clarification of the menstrual disturbances so frequently seen during the shock treatments.

The study is based on the review of 687 records of female patients of the New York State Psychiatric Institute who received electric shock treatments between the years 1942 and 1949, and the review of 200 records of patients treated by insulin coma between 1942 and 1951.

One hundred and fifty-nine patients of the group treated by electric shock and 61 of the group treated by insulin coma were in the hospital long enough before treatment to menstruate twice, thus contributing a control cycle to be compared with the cycle after shock treatment. The average length of the control cycle was 28.5 days, slightly longer in the younger group, shorter in the older group of patients.[1]

When electric shock treatment is superimposed on the physiology of the menstrual cycle, frequently drastic changes may be evoked in the cycle which is current when electric shock treatment is begun. Menstruation may be precipitated prematurely or, more often, delayed, thus leading to amenorrhea. On the average, the menstrual cycle is not substantially lengthened in patients receiving less than 10 treatments. There is a significant increase in patients receiving between 10 and 20 treatments.[1]

The response to electric shock treatment in the individual patients is so unpredictable, and the distribution of the length of menstrual cycles so scattered that the correlation between the length of menstrual cycle and the number of shock treatments is of low order. The correlation is improved when all cycles which overlap with electric shock treatment are averaged in individual patients and these averages correlated with the number of shock treatments ($r=0.34$). It is further enhanced by combination of electric shock with insulin treatment ($r=0.58$). The correlation between the length of the menstrual cycle and the number of shock treatments permits the hypothesis that it is the shock treatment which is responsible for amenorrhea.

Clinical observations have established that individual shock treatments add up to summative therapeutic effect. A single treatment causes negligible therapeutic change, but a series of treatments leads to clinical improvement. The cumulative effect of shock treatment may also be demonstrated on the amenorrhea produced by electric shock treatment. The resumption of menstruation after the last electric shock treatment is increasingly delayed in proportion to the number of electric shock treatments. Again, a combination of insulin treatment and electric shock treatment further enhances the correlation ($r_1=0.29$, $r_2=0.38$).

Insulin coma treatment alone also produces amenorrhea. The average length of menstrual cycle in a group of 61 patients treated by insulin coma was 42.6 days. This average differed statistically at the 0.01 probability level from the average length of cycle preceding the course of insulin coma treatment in the same group of patients.[2]

The basic studies indicate that amenorrhea is a typical sequel of shock treatment,

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whether induced by electricity or by insulin. The amenorrhea is not constant and does not appear in each individual treated by shock treatment. It is rather a statistical phenomenon which emerges from the averages of large numbers of treated subjects. The statistical method indicates that shock treatment can be, at best, only partly responsible for the deviation in menstruation. The low correlation leaves open the possibility that other factors inherent in the treatment situation may be correlated to the amenorrhea.

In the present study the interest is centered on the relation between amenorrhea and the capacity of the patient to recover during treatment. For technical reasons the study was limited only to schizophrenic patients. A group treated by insulin coma was compared with a group treated by electric convulsive therapy alone and a group with combined insulin and electric shock therapies. Since previous studies had established that amenorrhea in patients given less than 100 electric treatments was insignificant, only patients who had received between 10 and 20 treatments were compared with the insulin group. The condition of improvement was based on the discharge notes in the records of the patients. They were classified into three grades: recovered, improved, and unimproved.

Several conclusions may be drawn from the results of these studies. (Table I). The degree of amenorrhea is not correlated significantly to improvement when electric shock treatment alone is given. Some degree of amenorrhea occurs in all three categories, but even though the amenorrhea is greatest in the recovered group, the differences between individual grades of improvement are not significant. Patients in all three grades were given electric shock treatment, and all three grades showed a degree of amenorrhea, but only one group recovered. These data indicate that giving electric shock treatment or the production of amenorrhea does not necessarily mean clinical recovery.

In contrast, when insulin, an endocrine substance, is used to produce the shock, the amenorrhea, which is also produced as part of the response to the treatment, is in more direct relationship to the beneficial effects of the procedure. The degree of amenorrhea is statistically related to the state of recovery.

The significance of the amenorrhea in relation to recovery produced by insulin shock treatment must be interpreted with full cognizance of the physiological meaning of the menstrual cycle. Menstruation is only the barren end-product of an intricately organized reproductive scheme. It is the visible show after unseen preparations, the smoke after the fire has burned out. The magnitude and quality of the hormonal preparation must not be judged solely on the waste product—that is menstruation. Menstruation is a function at least twice removed from the source of its original inception in the pituitary gland where it could conceivably be interfered with by shock treatment. There are at least two junctions, the ovary and the uterus, not considering the communication system, where the force of the original impact of shock treatment might be lost due to inertia, inactivation, or lack of response. If it is still possible to find moderately significant correlations between menstruation and recovery in insulin shock treatment, it is probable that direct hormonal essays either at the gonadal or the pituitary level would yield more significant information.

In conclusion we may say that amenorrhea which is characteristically involved in shock treatment was found to be significantly longer in patients who recovered with insulin coma by comparison with patients who did not recover.

TABLE I

Effect on the Menstrual Cycle of ECT Alone, ECT Combined With Insulin and Insulin Alone in Relation to Clinical Improvement.

	ECT		*ECT AND INSULIN*		*INSULIN*	
	N	*Cycle*	*N*	*Cycle*	*N*	*Cycle*
Recovered	37	45.5	24	54.7	27	58.8
Improved	38	39.7	44	45.8	42	37.5
Unimproved	28	39.6	23	38.7	26	37.2
Difference Rec.-Unimpr.	5.9		16.0		21.6	
†	.80		1.81		2.10	
Significant	—		0.10		0.05	

There was no relationship between amenorrhea and the recovery state in patients who were treated by electric shock treatment alone.

The results of the investigation suggest that an endocrine factor, presumably located at the pituitary level, may be involved in the shock therapies of the psychoses.

Use of Psychologists and Psychiatric Social Workers in Supervised Psychotherapy in Private Practice

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The objective of this paper is to suggest a partial solution to the vexing problem, existent in many localities, of not having sufficient psychiatric help available to fulfill community needs. This paper is a report of the first year's operation of an experiment designed to ameliorate this situation, by the utilization of psychologists and psychiatric social workers in supervised psychotherapy in private practice.

After several years in private practice, it was felt by the writers that a relatively large group of potential patients were missing opportunities for psychotherapy, because of inability to meet the financial problem of the prolonged care. It was thought that for the most part, these individuals fall into a middle income group. They are not able to meet the usual psychiatric fees, and at the same time these patients would not be eligible for a free clinic. Since only a certain percentage could be seen at a reduced fee, those chosen for treatment usually were the patients capable of interpretive types of treatment.

This left a large number in need of supportive and/or relationship therapy who would be without a suitable place to go for help, unless they could be handled by a social agency. The idea was conceived that this group would be suited for therapy by psychologists and psychiatric social workers under psychiatric supervision.

Since most of these psychologists and psychiatric social workers were already having considerably to do with the treatment of patients in a free clinic, the adopted plan also served the function of providing a means for the additional teaching and training of these workers. It was anticipated that a good many of these patients, who might be regarded by the psychiatrists as utilizing time which might be spent to better advantage in other areas, were of a great deal more interest to the supervised therapists. It was also anticipated by the psychiatrists that potential patients would no longer be able to avoid treatment with such rationalizations as, "I cannot afford it," "I do not want charity," or "Psychiatrists are too busy to see me."

A group was organized with a staff consisting of two psychiatrists, four psychologists, three psychiatric social workers, and a nurse receptionist—the group being comprised of both sexes, different age groups, different personalities, and varying training levels. The limited choice of suitable workers in part made these variations coincidental, but at the same time it was felt that these differences provided an available degree of flexibility which could be utilized in the assignment of patients for therapy—the age and sex of the therapist providing possibilities for a parent or sibling figure in keeping with the patient's needs. The personality of the therapist, in terms of firmness, permissiveness, or attitude toward dependent strivings, also was something that could be predetermined by each patient's individual needs. It was felt that the variations in training, background and culture of the psychologists and psychiatric social workers, together with the differences in approach to the patient, would be of advantage to satisfy specific needs of various patients.

For example: A patient who in terms of his dynamics had a strong need for limit

setting and external restraints, would be assigned to the therapist who in his own personality structure was able to be firm yet accepting. He would not be assigned to a member of the group whose personality structure emphasized permissiveness.

Another example would be: A patient who might have had an early unhealthy relationship with a threatening, demanding father, would deliberately be assigned to an older male therapist who could provide a sustained corrective emotional experience, in terms of his being accepting and encouraging.

It is the opinion of the writers that this is somewhat different from what is called manipulation of the transference, in which a therapist assumes a certain attitude which can or cannot have an artificial aspect. In the above instances, the therapist was picked because of personality reactions quite comfortable and spontaneous for him. This provides what is considered to be a corrective medium, but does not provide the flexibility of the experienced therapist. The emphasis, then, is placed on the spontaneous consistency of the therapist's responses, rather than the adaptability which goes along with greater understanding and experience.

The patients treated by this group came from varying sources, such as local physicians, relatives, friends, various agencies, the psychiatrists in the group and self referrals. From these, patients were chosen for therapy if they fell into what is referred to above as the "middle" group. Some of them were borderline states in need of supportive help. The cases in which it was felt that hospitalization would be indicated at some stage in treatment, or who were likely to become psychotic or suicidal, were excluded. Some patients were in need of supportive care for such things as difficult realistic problems, but those in whom there might be difficult transference reactions, such as ever increasing needs for more frequent visits, or too great an intensity in the relationship beyond the scope of the supervised therapist, were also excluded. Some of the patients were in need of relationship therapy, particularly along the lines of a corrective emotional experience. There were also cases in which it seemed most practical to think of brief therapy with a limited goal. For example: Patients whose motivation was expected to diminish with relief of symptoms, or those who were considered to be unable to tolerate the intensities of interpretive therapy.

Process:

The actual mechanics of the initial evaluation of a patient seen through this group are as follows:

After a social history has been obtained by the social worker, the patient is seen by the first psychiatrist, during which interview the emphasis is placed upon obtaining the dynamic and genetic factors in the patient's history. The patient is then seen by the second psychiatrist who focuses on an evaluation of the patient's ego structure, the prognosis, and his greatest needs. When indicated, psychological testing is done emphasizing projective techniques, with assignment of patients in rotation among the psychologists.

The advantages of this multiple approach are many. Dynamically significant material can be obtained by the difference in the way the patient presents himself to male as contrasted to female interviewers. For example: A provocative patient, with a fair amount of modifiability, may be less hostile to the third interviewer than he was to the first. Blind spots are much more apt to be avoided if there are more than just one interviewer. It is of subsequent help in the supervision and total handling of the patient for both of the psychiatrists to have a working knowledge of the patient, and the patient's having been seen by a number of different people in the group serves as a stimulus to group discussion at the time of the staff conference and assignment of patients to therapists.

Staff Conference:

The next step in the planning of the patient's treatment is a discussion of the individual patient, and the material obtained from him by all those of the group who have seen him, at a staff conference. Here, aside from arriving at a clinical diagnosis, emphasis is placed on understanding and discussing the genetic and dynamic factors which play a part in the patient's illness, and which may be utilized in his therapy. Decisions are made relevant to the patient's

strength, his needs, the goals of therapy, the level at which treatment shall be conducted, and the therapist who, in keeping with principles outlined earlier in this paper, can best function, in a spontaneous manner by virtue of his own personality factors, in such a way as to help the patient restore a comfortable degree of equilibrium in his personal functioning. Whenever possible, and when this does not conflict with the patient's needs, it is preferred that a therapist be assigned on the basis of a spontaneous feeling on his part that this patient is a person with whom he would like to work.

The treatment of patients by the individual therapist in this group is conducted under the supervision of the associated psychiatrists. Recognizing that there can be some resistance on the part of certain therapists to supervision, a definitely planned supervisory schedule for each patient in treatment has been established, so that it is obligatory on the part of the therapist to review each case with one of the psychiatrists at stated intervals. In addition, wherever the patient's needs indicate, or where the therapist himself feels the need, additional supervisory sessions are arranged. The object of these sessions are threefold—First, to keep the psychiatrist posted on the progress of both patient and therapist, as a means of fulfilling the psychiatrist's responsibility to the patient. Second, to direct the therapist in the treatment and handling of the patient. Third, to further the training of the therapist. These sessions provide the supervising psychiatrist with an opportunity to help the therapist modify some of his blind spots, and also with a closer concept of the type of patient with whom the therapist does his best work; this knowledge can be very helpful in the future assignment of patients. In addition, these sessions provide an opportunity for discussing and handling either termination of therapy or transfer of patients to different therapists. For example: If it were felt at the initial conference that the patient was in need of support and it was recommended that he see a female therapist, then subsequently at a supervisory session it was discovered he might progress further with a male therapist, the techniques of such a change would be arranged.

Results:

Our experience with this experimental plan, in its first year of operation, is as follows: 142 patients were seen, 90 of whom were treated, the number of interviews ranging from 1 to 56, with an average of 13. (This includes recent beginners.) The ages of patients ranged from 18 to 56, with 83% in their 20's and 30's; 73% were married and 53% were males; 54% were diagnosed as having character disorders, and 39% were neurotic problems with only an occasional depressed or schizoid patient being accepted for supportive therapy; 63% of the total were referred by physicians, 20% sought help of their own accord, and most of the others were referred by social agencies. The therapists were asked to rate the patients treated as to whether the condition was—(1) markedly improved, (2) mildly improved, (3) not improved, or (4) worse, and every effort was made to have this rating, of those who terminated therapy after more than one interview, 18% were markedly improved, 41% mildly improved, and 41% not improved.

Discussion:

Although no definite conclusions can be drawn from the number of cases handled, we felt that our experiment demonstrated certain advantages as well as disadvantages.

Some of the positive aspects were considered to be as follows:

First, it was found in re-evaluation of the patients by the psychiatrists, after a year's period of therapy, that the therapists apparently had been able to be relaxed and accomplish more because of the sharing of responsibility between the therapists and the psychiatrists.

Second, it provided the opportunity for psychiatric help for a group of people who might not otherwise have had access to it.

Third, it gave an opportunity for a corrective medium in anticipation of the patient's therapeutic needs.

Fourth, it often provided more security for patients who might be threatened by a one to one relationship at the beginning of the period of investigation.

Fifth, treatment by a non-medical therapist sometimes undercuts a patient's need to

avoid therapy by playing into his neurotic defense, i.e. a feeling he is not sick enough to warrant treatment by a psychiatrist.

Sixth, it provides, at least directly the opportunity for psychiatrists to utilize their knowledge and experience in providing help for a greater number of patients than could have been reached on an individual basis.

Seventh, it helped to leave the psychiatrists freer to apply their highly specialized techniques of treatment in areas where this might not have been possible otherwise.

Eighth, it provided an evaluation team for many legal and court problems where it was felt that a group opinion carried more weight than would that of an individual.

Ninth, it provided additional training of psychologists and psychiatric social workers in the handling of certain patients based on a dynamic understanding of emotional illness.

Tenth, it provided enough additional financial help for the part time workers in the group to encourage them to continue in important full time jobs in valuable community agencies.

And last, it is beginning to attract and encourage other workers to come to the community to work in community agencies by virtue of the added income and training provided through this service.

Some of the diasadvantages noted have included the following:

First, some patients came to regard their therapy as second rate and took it to mean that they had been rejected for treatment by the psychiatrist.

Second, changes in the staff which on occasion necessitated transfer of patients sometimes operated to the patient's disadvantage—again giving rise to a feeling of rejection, and in some cases leading to premature termination of treatment.

Third, blind spots of individual therapists have on occasions led to mishandling of patients.

Fourth, occasional unconscious encouragement by the therapist of "acting out" by the patient, or in other words, vicarious acting out by the therapist.

And last, the hesitation with which some members of the medical profession in the community have accepted the treatment of patients by non-medical personnel, despite the wide acceptance of this type of approach in many of the leading psychiatric clinics in the country.

Some of the ways in which it is hoped that operation of an organization such as described in this paper can be improved upon would include—a larger degree of permanency of staff members, increased training and experience by psychologists and psychiatric social workers in handling psychiatric patients under psychiatric supervision, and a greater acceptance by the medical profession as a whole, of a new method in psychiatry which already has found wide acceptance in other fields of medicine.

Summary:

An experiment was described in utilizing psychologists and psychiatric social workers in supervised psychotherapy in private practice. The purposes and objectives of such an approach were discussed, following which techniques were described, the results reported, advantages and disadvantages evaluated, and some considerations for the future suggested.

Effect of Electrically Induced Convulsions Upon the Opossum

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"Freezing" or "playing dead" has been termed tonic immobility by zoologists. It has been reported in a wide variety of vertebrates, from amphibia to mammals and many speculations have been offered as to its mechanism. This type of reaction is marked particularly and proverbially in the opossum (didelphis virginiana), the only surviving marsupial in the United States. "When attacked it rolls itself up like a ball, submits to be kicked and maltreated without moving; feigns death; lies on the ground with shut eyes, and cheats its assailants into the belief that it has been destroyed" (Audubon).

The responses of a psychiatric patient for whom electric shock treatment was being considered reminded us of an opossum "playing dead." This idea, at first something of a pun in a clinical discussion, led to the following experiments and observations which were carried out during the spring months of 1949.

Wild opossums were supplied by hunters. In captivity they waxed fat on a diet of commercial dog food, sweet potatoes, and cabbage. There were four males and six females. No difference was observed in the behavior of the sexes. The males were slightly larger. The animals varied in coloration between dirty grey and almost pure black. The darker ones are locally known as "black jacks" and considered by hunters to be more fierce and less likely to "play dead." In our experience this was not true.

Before experimentation began the animals were allowed three weeks to become accustomed to the cages. Manipulation was kept to a minimum. There was considerable variation in the innate personality of the creatures. Some were more apt to snap and snarl and others more easily thrown into tonic immobility. All would bite savagely when molested in a dark corner, but in bright light they were apt to merely threaten to bite, to "freeze," or attempt to unobtrusively slip away. The animals never became pet or friendly but remained as "mean" at the end of three months' captivity as when first caught. To the last they seemed startled by the experimentors. Only one animal was sufficiently bold to feed in the presence of a man and this was unlearned, for it did so on the very first day of captivity.

The animals were observed under the following circumstances. A cube-shaped box measuring about one foot in each dimension was covered with screen wire. The box stood under a bright light in a very quiet laboratory and a mirror was placed at an angle over the screen top. In this way the experimentor could sit quietly in the dark some distance away and observe in the mirror the animal's actions in the box, and yet remain himself unseen by the animal. On the floor of the box steel rods were placed one inch apart, and alternate rods were wired to opposite poles of a condenser. A buzzer was attached to one side of the box. An air hose was fitted in such a way that a blast of air could be directed down and across the bottom of the box; the passage of air was accompanied by a loud whistling sound. All animals were hungry when tested and had been awakened at least thirty minutes before. We quickly learned that tonic immobility is induced by stimulation and broken up by further stimulation. A calm unmolested animal moves gracefully and rhythmically. The molested and excited animal moves in a jerky, erratic fashion; movement seems to come in bursts. During the process of simply being removed from the cage, opossums pass rapidly in and out of tonic immobility. When an animal is placed in the brightly illuminated cage, at the instant of removing of one's hands, it usually "freezes" for a minute or more. Then it be-

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gins to explore its surroudings cautiously. During this period of exploration the slightest noise in the laboratory, even the squeak of a fountain pen or paper, might cause it to stop, attempt to locate the noise and turn toward it. Within a few minutes this subsided and the animal would sit or lie down and cease reacting to minute noises.

Ten minutes after the animal had been placed in the box it was given a stimulus. In the instance where it was given a small and short electric shock through the feet, the animal would jump, growl, hunch up, and look from side to side, all within a second or two. Then it would become immobile. Respiration would cease for 15 to 30 seconds and then suddenly begin at the rate of 40 to 50 per minute. With some patience it was possible to affix electrodes to the skin over various muscle groups and record electromyograms. If the animal freezes in an awkward and apparently uncomfortable position, muscular action currents of large amplitude are present. If the animal freezes in a natural, "comfortable" position, muscular action currents are practically absent and an electrode placed anywhere on the body records an uncontaminated electrocardiogram. The heart rate, as determined by electrocardiographic records, just prior to the shock would be between 160 and 180 per minute. Within two or three seconds after the shock it would increase to 270 to 300 beats per minute. Thirty to 60 seconds after tonic immobility began, the heart rate returned to normal and for the remainder of the immobile period a slight bradycardia was present. The respiration slowly decreased in rate and when it had dropped to 25 or 30 per minute, the animal was starting to move again. It would first blink an eye or move an ear, then it would wiggle its nose and then move its head. Activity would gradually return until it was again cautiously exploring the box. The time spent in tonic immobility was usually between one and two minutes. After the "freeze" the animal passed again through the stages of being alert to small noises and then settled down with no further exploration.

The response to one short unpleasantly strong electric shock applied to the feet has been described above. If instead of one shock, the animal was given a series at the rate of one per second, it jumped and growled and with the repetition of the shocks became more and more excited and frenzied, snarling and snapping, and whirling about within the box. With the cessation of stimulation it froze within a second or two. In general, the more excited the animal appeared to have been, the longer the "freeze" following it would last.

When the buzzer was sounded, the response was essentially the same. After buzzing for one second, the animal whirled, growled, faced the sound, and froze. Buzzing for one minute produced at first the same whirling, growling, orientation, and "freezing." As the sound continued, however, the animal moved again rapidly at random as if trying to run away. Usually the animals snarled and snapped at the buzzer, and one opossum bit the cover off the instrument. A short hissing blast of air produced behavior no different from that following other short stimuli. If the blast was continued, the animal became active again and by random movements attempted to get out of the air current. The animals usually came to rest lying parallel to the direction of the air current. When the air is turned off, the animal froze.

If a prolonged stimulus of low intensity, a very faint sound for example, was used instead of the stronger ones described above, the animal quickly faced it, became immobile for about one minute and then gradually began to look around. Within three or four minutes it seemed to ignore the sound. Immobility produced by low intensity stimulation did not seem as complete for the animal breathed quietly. When the sound ceased, the animal paused again with no visible motion for 10 to 30 seconds before resuming exploration.

The immobility which followed the cessation of a strong sensory stimulus was timed for 11 different animals. Seven underwent 10 electrically induced convulsions during a period of seven days. Four were used as controls. The control animals were taken out of their cage an equal number of times. Electrodes were clipped to the ears of all of them but the controls received no electric shocks. The period of immobility produced

by the same intensity of stimulation was again measured one day after and 13 days after the series of convulsions. Table One shows the results. Unfortunately, Sleet, one of the four control animals, mysteriously disappeared from the laboratory before the final test.

TABLE ONE

Animal Name	First Test	Post Shock 1 Day	Post Shock 13 Days
"TREATED" ANIMALS			
Steve (male)	180 secs.	1 sec.	45 secs.
Flossie (female)	60	20	75
Jigs (male)	90	0	135
Duke (male)	60	15	50
Dash (female)	160	0	105
Jamie (female)	180	15	45
Daisy (female)	335	5	75
Average	126	8	76

Animal Name	Pre-Shock	Post Shock 1 Day	Post Shock 13 Days
CONTROL ANIMALS			
Sam (male)	135 secs.	165 secs.	135 secs.
Squirt (female)	15	30	65
Sweet Potato (female)	120	300	240
Sleet (female)	60	150	—
Average	83	199	147

Equally as impressive as the reduction of "freezing" time, was the marked behavior change that the animals undergoing convulsions showed after the fifth, or at the latest, the eighth shock. They became excitable and aggressive. They now were very hard to handle and placing the electrodes on their ears became a major task. When dropped into the cage, instead of "freezing" they would struggle to get out, bite, snarl, and were little furry balls of fury. The control animals, who were simply removed from their cages and had electrodes placed on their ears, became easier rather than harder to handle. The movements of the "treated" animals no longer were erratic and jerky, and no longer came in bursts. It was more difficult to induce immobility and, once induced, it would last a shorter period of time. Even 13 days later, immobility was definitely shorter in 5 out of 7 animals.

Discussion

There can be no doubt that electrically induced convulsions alter considerably the reaction type of the opossum. Instead of reacting to sudden and unexpected stimuli with immobility and gradual resumption of activities, the "treated" opossum becomes immobile for a shorter time or not at all, and behaves in general less cautious and more aggressive.

One might at first be tempted—and it seems that some authors have given way to this temptation—to regard tonic immobility as evidence of anxiety, and then to postulate that the electric shocks have "cured" the animals. Such an anthropomorphic view must be regarded as naive. If the opossum's tonic immobility were evidence of anxiety in the sense of human psychopathology, one would have to wonder why every member of this species reacts in the same form and why none selects another way of dealing with its alleged anxiety. One could also state with equal anthropomorphic justification that to react to a possible threat by way of "playing 'possum," demands courage since running away might be a better way out. It might be permissible, however, to be reminded of catatonia (Wiedorn).

Experiments with rats, cats and humans have shown that conditioned responses also of long standing are temporarily, and sometimes permanently, extinguished by electrically induced convulsions. However, "freezing" in the face of a sudden and possibly threatening event is a "primitive" and unconditioned response of which even insects are capable. It is interesting that electrically induced convulsions rather easily affect such a potent and fundamental inhibitory pattern and replace it with a more impulsive and more aggressive approach to the environment. The mode of action remains unknown.

Summary

The effect of a series of ten electrically induced convulsions upon tonic immobility in the American opossum (didelphis virginiana) is reported. Convulsions markedly alter the animal's instinctual pattern of reaction to stimuli. Instead of maintaining tonic immobility opossums show, at least temporarily, a much more aggressive type of adaptation.